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PROGRESS REPORT #3

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SKYLAB PROPOSAL EPN 435

CONTRACT NAS 9-13359

6 AUGUST 1974

Principal Investigator -- Ernest G. Stoeckeler (currently on extended sick leave)

Co-Investigators -- Raymond G. Woodman and Robert S. Farrell

Title: "Multidisciplinary Analysis for Highway Engineering Purposes"

To date the S-190A and S-190B photography shown on the attached maps has been received. No S-190B photograph is available for any September 73 orbits. The 9-10-73 S-190A photos are usable only in the B & W IR 70mm. CIR and Color products are too dense for useful analysis, and haze is present on the other two bands. The 4X enlargements of the CIR on this date, as well as the B & W IR, have been of little use for geomorphology because of the grainy quality of the transparencies. The coastal orbit of 9-21-73 appears to be of considerably better quality, but work has not yet begun using these products.

The 1-14-74 orbit coverage is partly obscured by haze and clouds for nearly 60% of the path over Maine, while the remainder is of superb quality.

Surficial geologic mapping of all or part of twenty-five 15-minute quadrangles in western Maine has been completed using S-190A (9-10-73), U-2 1:125,000 CIR (9-17-73 and 6-3-73), and 1:43,000 and 1:31,680 scale B & W photography. The quadrangles are located in the stereo overlap areas of S-190A frames 39,40, and 41. The study has been restricted, because of haze, to the B & W IR frames. The majority of this region is lightly populated, and very little surficial geologic mapping has been completed. Detailed study of portions of the area was published by Leavitt and Perkins

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(E74-10699) MULTIDISCIPLINARY ANALYSIS
FOR HIGHWAY ENGINEERING PURPOSES
Progress Report (Maine Dept. of
Transportation, Augusta.) 9 p HC \$4.00

Unclas
CSCL 08B G3/13 00699

in 1935. Borns¹ and Calkin (1970) and Borns (unpublished field maps) have completed detail mapping of six quadrangles. Caldwell (1959) published a study of glacial Lake Farminton located at the southern edge of the mapped area.

The study of SKYLAB photography for geomorphology was performed in the following manner:

- (1) SKYLAB S-190A photos were studied for glacio-fluvial deposits. The following esker systems could be identified:
 - The Stratton Esker
 - Esker NW of Chain Lakes
 - Dallas to Reddinton Esker
- (2) S-190A photos and 15' quadrangles maps were used to extract further information. Little additional information could be gleaned.
- (3) U-2 and conventional aerial photography was used to complete a reconnaissance map of the area. Based on this map, a glacial landform classification was developed. The categories are:
 - a) Eskers and linear esker-like kame terraces
 - b) Deltas and esker deltas
 - c) Kame terraces and kame fields
 - d) Moraines
 - e) Others: fluted till, drumlin fields, ice trend movement direction
- (4) Using the additional information gleaned from the aerial photographs, the S-190 photos were restudied. No additional eskers could be identified with certainty. Deltas were evident because of the change to hardwood growth in their well-drained soils. Kame fields and kame terraces were not detectable except where drainage is poor. Another possible classification began to emerge in this restudy, glacial lake sediments. Extensive areas are known to have been covered by glacial lakes (Borns personal comm., 1970). Areas where glacial lake sediments are believed located are marked by thick pure stands of softwood in the lowlands often surrounding present-day lakes. The soils here are believed to be silt, silty clays and silty sands.

¹ Doctor Harold Borns, Professor of Geologic Science, University of Maine, Orono, Co-Investigator.

Pure softwood stands also occur on slopes and on the tops of some hills. Pure stands of softwood are good indicators only if they occur in low areas. Field checking is necessary before this classification can be confirmed.

As we stated, only the B & W IR were used, namely RL37 (0.7-0.8 μm) and RL38 (0.8-0.9 μm), which penetrated the haze. Most detail could be gleaned from a stereo combination of RL38 and RL37. Slight differences in the reflectivity of the vegetation cover added significantly to detectability. Without this aid the few eskers that were detected would have been missed.

The CIR 70mm photography on this date is extremely dense for stereo viewing. An attempt was made to make DIAZO copies using RL37, RL41, and RL42 (0.8-0.9 μm , magenta; 0.6-0.7 μm , cyan; and 0.5-0.6 μm , yellow) respectively. A long exposure was necessary for RL42 and 41 photos. Detail on the final combinations was not good.

Of the 21 major eskers and esker segments mapped in this area, only 4 major lengths could be seen on SKYLAB photographs. This was believed to be the result of:

(1) Lack of relief on most eskers.

The Stratton Esker has over 100 feet of relief, as does the associated terrace. The esker northwest of Chain Lakes has similar relief: Most eskers have relief measuring only tens of feet.

(2) Lack of vegetation contrast.

The Dallas-Reddington Esker is marked by a distinct line of hardwoods in a softwood swamp: Most eskers are not so marked.

(3) The elevation of surrounding trees is nearly the same as the elevation of the glacial feature. If it were possible to see below the canopy, smaller features are believed possible to detect (this has been confirmed by 14 January 74 winter S-190A photos #51, 52, and 53 in another remote area in eastern Maine).

The conclusion has been that 'leaf-on' S-190A photography is not suitable for detection of glacio-fluvial deposits under most conditions.

The same granular deposit detected on S-190A photos could also be detected on 26 November 1973 ERTS-1 imagery (1491-14581, 1491-14575, bands 6 and 7), as well as several esker segments, moraines, large glacial stream cuts in bedrock, and some fluted tills. The ERTS-1 imagery has a maximum snow cover of 5".

If the ability to detect glacial lake sediments is confirmed by field checking, this will be a major contribution of SKYLAB S-190A photography to the surficial geologic mapping of western Maine.

There is some hint that the slightest tonal differences in hardwood stands may be excellent indicators of well-drained to excessively drained soils, suggested by some of the larger deltas that are detectable by their hardwood cover. Other areas of similar appearance have unknown soil types. If this feature can be confirmed it may facilitate engineering soils mapping and hydrologic studies, as well as aid in USDA soils mapping presently being conducted in the region.

S-190A photography for 1-14-74 was received in June, 1974, and S-190B photography for 1-14-74 was received in July, 1974. With the completion of the office evaluation of the S-190A photograph of western Maine, attention has shifted to the S-190A and B winter coverage. The surficial geology of the region east of the haze line on the 14 January 74 orbit is comparatively well known. Borns (1963, abs. 1966, 1968, 1973) has done extensive study along the coastal fringe of this orbit (frames 51-52, attachment 2). The interior areas have not been studied. This orbit provides the opportunity to study a geologically well understood area and follow, if possible, the glacial deposits northward into an unstudied area.

The same framework used in the western Maine geologic study will be followed. The S-190B photography has been studied first. Doctor Borns is presently using copies of S-190B in his field work in this eastern Maine area. This investigator has completed a reconnaissance of the area

using S-190B CIR obtained on Orbit 83, January 14, 1973. Results have been excellent. Some esker systems can be traced for 45 miles, and deltas, moraines and some kame fields are easily detected and correctly identified. Snow cover is 5 to 6 inches over most of the area, and hardwood stands are leafless (hardwood predominates on well-drained glacial materials of deltas, eskers, kames, and moraines). Using a B & L Zoom 95 Stereoscope, 20X or more enlargements of stereopairs provide excellent viewing. The stereopair is taped to a plexiglass plate, allowing scanning without constant readjustment.

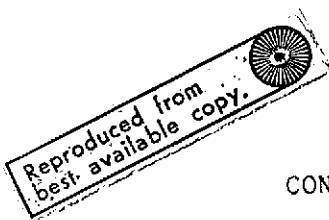
At present a detail reconnaissance surficial map is being prepared using 31 January 73 U-2 and 24 March U-2 photography. The 31 January photos have about 10 inches of snow in most areas and afford excellent correlation with the very similar conditions of the 14 January 74 SKYLAB photos. In areas compared to date, it is found that minor additional information can be gained from the U-2 over the S-190B photos; only the smaller details are missed (i.e. individual kames and small moraines with relief of 5 feet or less).

This U-2 reconnaissance geology map is expected to be completed shortly. Work will then shift back to a detail correlation between the U-2 and S-190B photos.

S-190A 70mm photos received have not been analyzed. We are presently awaiting the 4X enlargements for analysis. The first impression is that there is little advantage to IR, CIR and Color over B & W photos, due mostly to snow conditions. There also appears to be more detail discernible on the B & W photos than the IR or color photos.

Most study to date has been concerned with the geologic aspects of the proposal. Upon completion of this phase and after the 2X and 4X

enlargements of S-190A and S-190B photography have been received, the other disciplines will be investigated, using the 9-21-73 S-190A products as a basis. All bonds of this photography appear to be of excellent quality.



APPENDIX "A"

QUARTERLY
CONTRACTOR FINANCIAL MANAGEMENT REPORT

Contract Number NAS 9- 13359

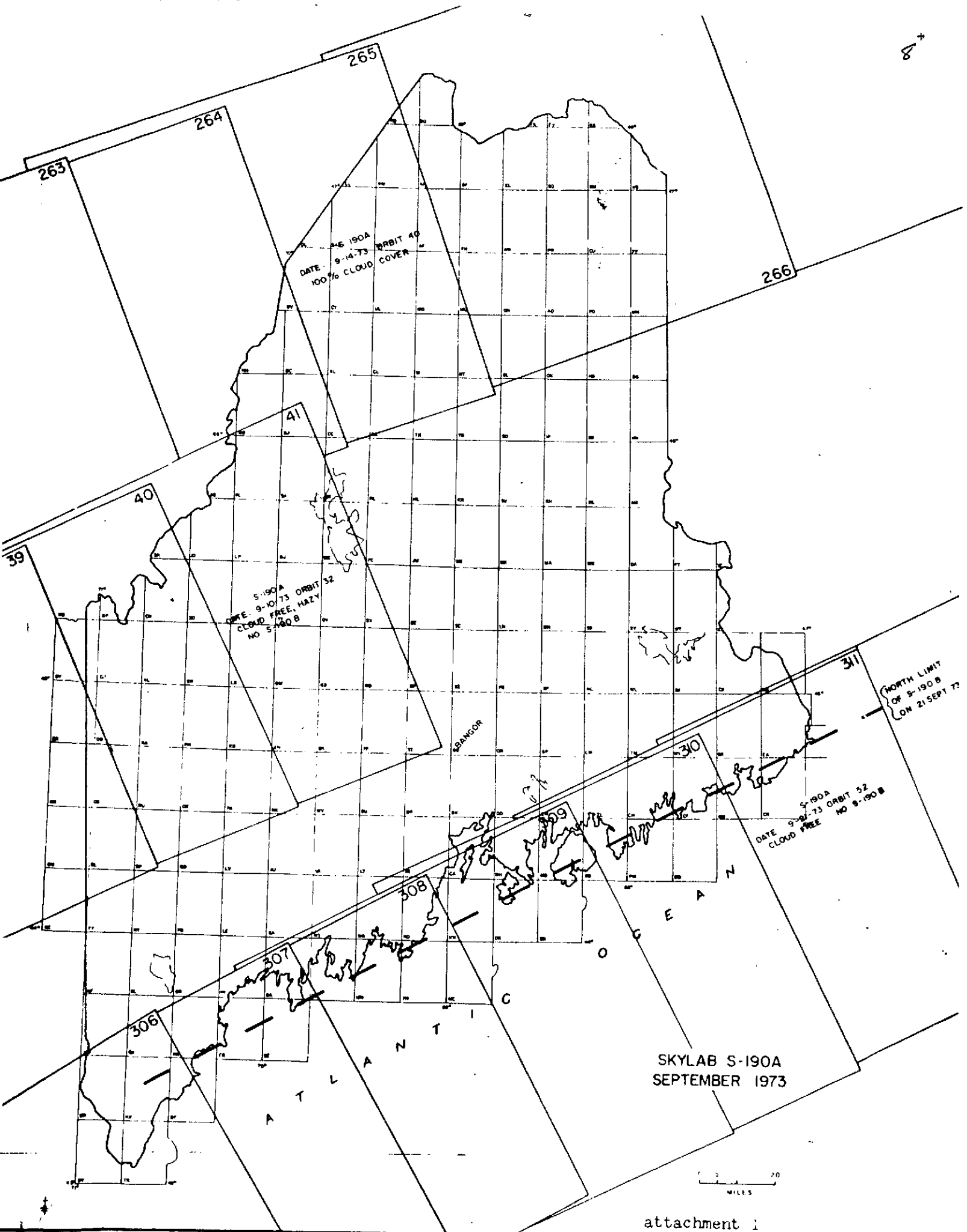
Contractor: Maine Department of Transportation
Bureau of Highways
State Office Building
Augusta, Maine 04330

Total Estimated Cost: \$20,800.00Task Description: "Multidisciplinary Analysis For Highway Eng. Purposes"Prepared By: Robert Farrell Date: 6 August 74

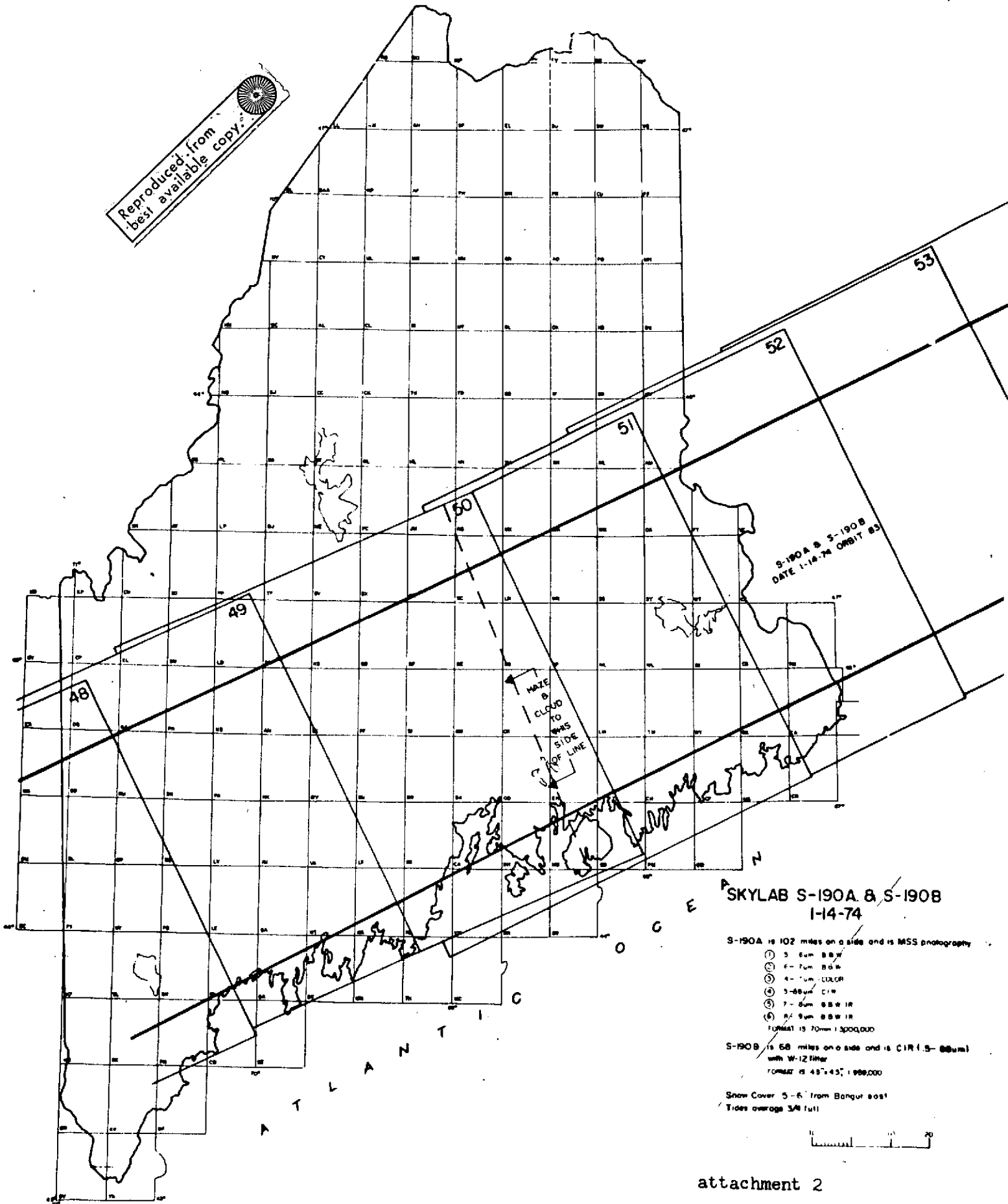
	MOST RECENT QUARTER	CUMULATIVE TO DATE	ESTIMATED TOTAL
HOURS			
Investigator	<u>179</u>	<u>420</u>	<u>2100</u>
Other	<u>724</u>	<u>985</u>	<u>1000</u>
Total	<u>903</u>	<u>1405</u>	<u>2100</u>
COSTS			
Labor	<u>4349.20</u>	<u>7069.79</u>	<u>12,800.00</u>
Material	<u>---</u>	<u>---</u>	<u>300.00</u>
Data Processing	<u>---</u>	<u>---</u>	<u>---</u>
Travel	<u>19.66</u>	<u>57.06</u>	<u>900.00</u>
Equipment Rental	<u>---</u>	<u>---</u>	<u>---</u>
Equipment Purchase	<u>---</u>	<u>106.60</u>	<u>560.00</u>
All Other	<u>4546.40</u>	<u>5103.39</u>	<u>6,240.00</u>
Total	<u>8915.26</u>	<u>12,636.84</u>	<u>20,800.00</u>

20,800.00

12,636.84\$8,163.16 Remaining end of July, 1974



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SKYLAB S-190A & S-190B
1-14-74

S-190A is 102 miles on a side and is MSS photography
 (1) 3-6um B&W
 (2) 4-7um B&W
 (3) 4-7um COLOR
 (4) 3-6um CIR
 (5) 7-9um B&W IR
 (6) 8-9um B&W IR
 Format is 70mm 1300x1000

S-190B is 58 miles on a side and is CIR (3-6um)
 with W-12 filter
 Format is 48" x 43" 1000x1000

Snow Cover 5-6" from Bangor east
 Tides average 3/4 full

